Mites in Floriculture

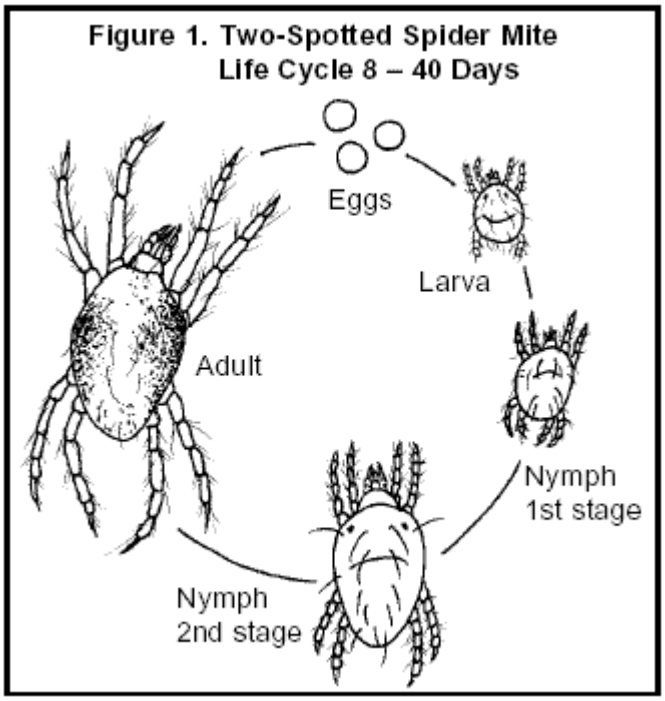
March, 2016

Mites of Floriculture Crops - Biology and Control

Mites are not insects. They are arachnids, the same class as spiders. Several mites attack greenhouse and field floriculture crops. Economically important species include the two-spotted spider mite, Lewis mite, bulb mite, cyclamen mite, broad mite and false spider mites.

Two-Spotted Spider Mite

The two-spotted spider mite, *Tetranychus urticae*, is known to attack over 300 plant species and thrives under greenhouse conditions. The adult female is yellow to greenish with two dark spots on the back and is about 0.5 mm long. Females lay an average of 100 eggs. The round, pearly white eggs are very small and difficult to see with the unaided eye. The newly hatched mites go through a larval and two nymphal stages before becoming adults (Figure 1.). The time from egg to adult is dependent on temperature. Numbers build up quickly under hot, dry conditions and it can take as little as 8 days at temperatures of 25 to 35°C to complete one generation. Diapause is induced by decreasing temperatures and day length. Female mites turn red and seek out cracks and crevices where they overwinter until spring. This overwintering stage cannot be controlled by pesticides. In B.C., two-spotted spider mites begin turning red in late August, and are mostly in diapause by mid-September.



Damage

Eggs are laid on the undersurfaces of leaves and all life stages feed there. Spider mites suck out plant juices by piercing plant cells with their straw-like mouth parts. A chlorotic spot or stipple develops at each feeding site as chloroplasts are sucked out along with the plant sap. Leaves eventually develop a mottled appearance. Severe infestations can result in leaves becoming pale, brittle, and parchment-like. Foliage can drop off and plant death may occur. As numbers build-up, mites form webs of fine silk on plant terminals leading to further aesthetic injury. There is some evidence that even low levels of mite feeding causes plant stomatal closure, resulting in decreased CO_2 uptake and reduced transpiration and photosynthesis.

Scouting

Spider mites cannot be monitored using sticky traps. Their detection depends upon the regular scouting of the underside of both old and new leaves. As well, look for stippling on the upper leaf surface as signs of mite feeding. Control efforts are more effective when applied at low infestation levels, so early detection is crucial. Be especially vigilant under hot, dry conditions that favour spider mite growth. A 10X power hand lens will help confirm the presence of mites on the lower leaf surfaces.

Management

Sanitation is the first step in managing mites. Weeds are common host plants, so ensure that weeds inside and adjacent to greenhouses are eliminated. New plants should be inspected for mites before placing them in greenhouses or planting them in fields. Do not keep any "pet plants" inside the greenhouse. Spider mites thrive on plants that are under stress. Be sure to keep plants watered, give them adequate light, and fertilize adequately but not excessively. Orient holes in overhead poly tubes so that plants are not under a direct blast of hot dry air. Heavily infested plants should be discarded. Bag or box plants before carrying them through the greenhouse, as spider mites can be inadvertently moved through the greenhouse on staff, equipment, and plants.

Biological Control

A highly successful biological control agent for control of two-spotted spider mites in greenhouses is the predatory mite *Phytoseiulus persimilis*. This mite is widely available from producers of biological control agents. Tropical in origin, this predator is well adapted to greenhouse conditions, but is not effective outdoors in B.C. Adult *P. persimilis* are shiny orange, while immature stages are a pale salmon colour. They can be distinguished from two-spotted spider mites by the lack of spots, the smooth teardrop-shaped body, and their faster movement over leaf surfaces. Each female *P. persimilis* lays about 50 eggs. At favourable temperatures (20 to 30°C), a generation takes about one week, half as long as a generation of two-spotted spider mites. One *P. persimilis* can consume 5 to 50 spider mite eggs, nymphs, or adults a day.

- *Phytoseiulus persimilis* is most effective at relative humidity greater than 70% and temperatures of 20 to 30°C. Very hot, dry conditions favour spider mites and can result in pest outbreaks, even with predators present. Ideally, foliage of adjacent plants should be touching, allowing the predators to move easily from plant to plant through the crop. They are not affected by day length and will remain on the crop as long as pest mites are present. Unlike some other predator mite species, *P. persimilis* only feed on mites and do not eat pollen. They will not survive between crops in an empty greenhouse and will disappear from the greenhouse. The most successful biological control programs are based on releasing predators monthly or even twice a month early in the cropping cycle on the assumption that the crop is likely to become infested with spider mites. Introduction rates range from 2 to 20 per plant, depending on infestation levels and the crop involved. Biocontrol suppliers can recommend more precise rates after inspecting the crop. "Hot-spots" can be treated with additional predators. Releasing some predatory mites into areas outside hotspots encourages them to disperse to look for food, which enables better overall spider mite management. At very high spider mite levels it may be advisable to apply insecticidal soap or other non-residual miticide, depending on the crop and time of year, in order to bring the spider mite levels down before introducing more *P. Persimilis*.

- *Amblyseius* (syn. *Neoseiulus*) *fallacis*, a predatory mite of temperate origin and native to B.C., has been developed for use in berry crops. This predator shows promise for two-spotted spider mite control in floriculture, but has not been fully evaluated. Another native B.C. predator is *Stethorus picipes*, a small (1 mm long), black ladybug beetle, known as the 'spider mite destroyer'. It is available as a commercial biological mite control agent for both greenhouse and outdoor crops.

Other biocontrol agents for mites include *Feltiella acarisuga*, a predatory gall midge, *Amblyseius californicus*, a predatory mite that eats pollen, other mite species and thrips, and *Amblyseius swirskii* which feeds secondarily on spider mites. These can be used in conjunction with *P. persimilis* for season-long mite control.

It is often necessary to apply pesticides for other insects or diseases while utilizing biological control agents in a crop. Select chemicals that will have the least negative impact on the biological agents. (See Table 7.1, page 17 in the 2008 Floriculture Production Guide). If possible, treat only hot-spots or spray only the part of the crop that is under attack, such as the upper parts of roses for aphid control. This will preserve the mite predators that are residing lower down in the plant canopy.

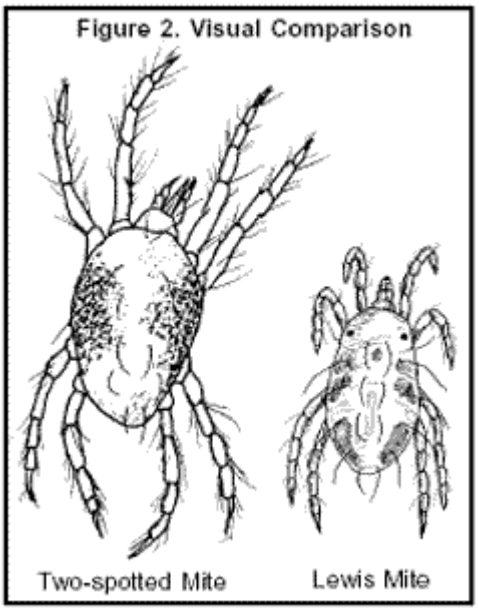
Chemical Control

Two-spotted spider mite populations can increase rapidly, so the potential for pesticide resistance development is high. Avoid using the same miticide for more than two consecutive sprays. Because spider mites are very small, relatively immobile, and occur mainly on leaf undersurfaces, thorough spray coverage is essential for adequate control. Most insecticides/miticides will **not** kill the egg stage, so two applications 7-14 days apart may be necessary, depending on pesticides to be used. A spreader-sticker or wetting agent will improve the effectiveness of most miticides, particularly on waxy leafed plants. However, the possibility of phytotoxicity may increase, so spray a small area before doing any large-scale applications. Product labels often have information on the use of adjuvants, spreader-stickers, or wetting agents.

Table 1 lists currently registered pesticides for mite control on commercial flower crops, as well as some additional information which will be useful when choosing a miticide. Check labels for specific crop registrations and possible phytotoxicity.

Lewis Mite

The Lewis mite, *Eotetranychus lewisi*, is a pest of poinsettias in B.C. Lewis mites are similar in appearance to two-spotted spider mites, but are slightly smaller and have several small spots rather than two large spots when viewed under a microscope (Figure 2.). The damage they inflict on crops is similar to that of two-spotted spider mites. They feed on the undersurfaces of leaves, piercing the epidermis and removing cell contents. This results in a stippled appearance on the upper leaf surface. Eventually the entire leaf becomes bleached and falls off. Heavy infestations will produce webbing, but not as extensive as that of two-spotted spider mites. Lewis mites do not enter a diapause or hibernation stage. The developmental time from egg to adult is 12 to 14 days at 21°C. Females oviposit 2 to 3 eggs per day for about 30 days.



Lewis mite is not a common pest in B.C., but poinsettia growers should monitor for it. Plants that appear to loose colour or have bleached foliage should be closely inspected for Lewis mites.

Scouting, management, and control methods for Lewis mites are similar to those for two-spotted spider mites. Note that imidacloprid, a commonly used insecticide for aphids and whiteflies, does not control spider mites.

Bulb Mites

Bulb mites, *Rhyzoglyphus* spp., are slow moving and relatively large (0.5 to 0.9 mm long). They are pearly-white and smooth, with short reddish legs. From their origin in Europe, bulb mites have spread throughout the world presumably via shipments of infested bulbs. Bulb mites occur as large colonies, not as individuals. Females produce at least 100 eggs that are deposited near injured or decaying tissue. The time from egg to adult can be as short as 12 days at 25°C. Factors affecting development time are temperature, humidity, and host species.

Damage

Bulb mites are usually considered secondary pests of bulbs, but can be responsible for serious loses. They invade bulbs at points of mechanical injury and, once established, they spread rapidly and destroy large areas of the bulb. In addition to feeding damage, the mites provide access to fungal root pathogens, such as *Pythium*, *Rhizoctonia*, and *Fusarium*. Infested bulbs may rot or produce stunted, distorted, or off-colour plants. Host crops include dahlia, freesia, gladiolus, hyacinth, iris, narcissus, orchid, and tulip. Vegetable bulbs can also be infested.

Scouting

Bulbs with apparent physical damage or rotted spots should be examined for bulb mites. They are easily seen with a 10X hand lens.

Management

Careful handling of bulbs to avoid the damage that provides access to mites is important. In storage, maintaining low relative humidities will reduce the potential for mite infestations. Steam pasteurization will eliminate bulb mites from soil.

Biological Control

Predatory mites, *Hypoaspis* spp., which feed on soil insects such as fungus gnats will help control bulb mites, however, bulbs must be free of bulb mites before planting in order to allow predators to be as effective as possible. *Hypoaspis aculeifer* is effective in controlling bulb mites in amaryllis, lily, and freesia. Suggested introduction rates are 100-500 *H. aculeifer* per m^2, depending on crop, media, and pest population.

Chemical Control

No pesticides are registered for control of bulb mites.

Cyclamen Mite

The cyclamen mite, *Stenotarsonemus (Phytonemus) pallidus*, is tiny (<0.2mm) and transparent. It does best at cooler temperatures (i.e. spring) and requires high humidity. Under optimal conditions the time from egg to adult is about 10 to 14 days.

Damage

Symptoms of cyclamen mite feeding often resemble disease symptoms. Cyclamen mites feed on all parts of the plant, but young foliage is most often affected. These mites avoid light, so they feed mainly on unopened

leaflets and buds, resulting in wrinkled, deformed leaves and buds that do not open or produce distorted blooms. New growth is deformed and distorted. Leaves may be thickened, strap-like, and reduced in size. As leaves unfurl they may show signs of scarring or bronzing. Favoured host plants include African violet, azalea, begonia, chrysanthemum, cyclamen, dahlia, delphinium, exacum, fuchsia, gerbera, geranium, gloxinia, kalanchoe, New Guinea impatiens, snapdragon, and strawberry.

Scouting

Recognition of the damage caused by these very small mites is the best way to determine the presence of an infestation. Especially characteristic are plants that have ceased blooming and have shortened internodes, distorted leaves and stems, and blasted buds. Infestations tend to be localized. Dissecting tissue under a microscope may be necessary to confirm the presence of cyclamen mites. Infestations in growing points look like a pile of salt grains.

Management

If only a few plants are affected, the best way to deal with cyclamen mites is to discard the infested plants. Workers should be careful not to spread mites through-out the greenhouse on their hands or clothing. Cyclamen mites on non-blooming plants can be killed by immersion, pot and all, for 15 minutes in water heated to 43°C. Decreasing humidity will reduce infestation levels.

Biological Control

No reliable biological controls have been identified for cyclamen mites. Predatory mites (*Amblyseius* spp.) and other generalist predators will feed on cyclamen mites but cannot be relied upon for control.

Chemical Control

All life stages will be present at once, and are well protected from sprays, therefore 2-3 applications at 7-10 day intervals is commonly needed for adequate control. Use sufficient spray volume and pressure to thoroughly cover all surfaces of the plants, including deep into the growing points. Dicofol (Kelthane) and endosulfan (Thiodan) will control cyclamen mites.

Broad Mites

Broad mites, *Plyphagotarsonemus latus*, are very small (0.1-0.2mm) and colorless. Under optimal conditions the time from egg to adult is about 5 days.

Damage

Broad mites attack a wide range of commercially important plants, including gerbera, African violets, cyclamen, begonias, impatiens, verbena and gloxinia. Broad mite damage is usually expressed as distorted and downward curling leaves resulting from a toxin secreted by the feeding mites. As well, internodes and petioles of flowers become shortened, and flowers may fail to open. Severely infested plants become stunted and may die.

Scouting

Broad mites are too small to be seen with a hand lens. A microscope is needed to confirm their presence. Broad mites prefer high relative humidity and therefore hide in growing points, flower buds, and overlapping surfaces of developing leaves. Although similar in appearance to cyclamen mites, broad mites can be differentiated by the whitish bumps on their eggs compared to the smooth eggs of cyclamen mites.

Management

Control of this mite is difficult. Ideally infested plants should be identified quickly and carefully removed from the greenhouse before the mites spread. Imported cuttings should be examined to prevent introduction into a non-infested greenhouse. Growers with broad mite problems one year should be especially vigilant the next spring for the possibility of a carry-over population.

Biological control

No reliable biological controls have been identified for broad mites. Predatory mites (*Amblyseius* spp.) and other generalist predators will feed on tarsonemid mites such as broad mites, but cannot be relied upon for control.

Chemical control

Forbid (spiromesifen) is registered for broad mite control. Other miticides applied to control spider mites may help control broad mites. Floramite (bifenazate) will not control broad mites. Use sufficient spray volume and pressure to thoroughly cover all surfaces of the plants, including deep into the growing points. All life stages will be present at once, and are well protected from sprays, therefore 2-3 applications at 7-10 day intervals may be needed for adequate control.

False Spider Mite

False spider mites or flat mites (Family: *Tenuipalpidae*) are flattened, very small (0.3mm long), reddish, and slow moving. The main pest species are in the genus *Brevipalpus*. Eggs are red, somewhat flattened, and take up to 3 weeks to hatch. The immature stages feed and develop for 5 to 6 weeks before becoming adults. A generation takes about 5 times longer than a generation of two-spotted spider mites. The *Brevipalpus* spp. attacks a wide variety of greenhouse plants and is commonly found on orchids. Additional hosts include palms, privet, citrus, walnut, and many other woody ornamentals and conifer hosts.

Damage

False spider mites are not common in B.C. greenhouses. When present, they feed first along the midribs of leaves and then disperse outwards. They puncture the epidermis of the leaf and suck out the plant juices. This results in the leaves having first a mottled and later a silvery appearance. Under conditions of severe infestations, plant tissue turns brown and dies. Stems are also attacked. False spider mites do not produce webbing.

Biological Control

Studies have not been done to evaluate biological control agents for *Brevipalpus* mites. It seems probable that *Phytoseiulus persimilis* and other predatory mites may feed on them, however, whether reliable control would be achieved is unknown.

Chemical Control

Pesticides that control two-spotted spider mites will also control false spider mites. Mites feed on the undersides of the leaves so sprays must be directed there and full coverage must be achieved for optimal control.

*Table 1. Miticides for Ornamental Crops**

Trade Name	Active Ingredient	Crops & Use Site	Mites Controlled	How it Works & How Long it Lasts	Life Stage Controlled	Resistance Management Group
Avid	abamectin	greenhouse	two-spotted	contact, moderate persistence	all stages except egg; takes 3-4 days for kill	6
D.D.V.P.	dichlorvos	greenhouse	two-spotted	knock-down, contact	all stages except egg	1B
Dibrom	naled	greenhouse & field	two-spotted	knock-down, contact	all stages except egg	1B
Lagon	dimethoate	field	all mites	systemic, moderate persistence	all stages except egg	1B
Malathion	malathion	greenhouse & field	two-spotted	knock-down, contact	all stages except egg	1B
Orthene	acephate	field	spider mites	knock-down, systemic	all stages except egg	1B
Thiodan***	endosulfan	greenhouse & field	cyclamen	knock-down, contact	all stages except egg	2A
Kelthane	dicofol	greenhouse & field	all mites	contact, moderate persistence	adult	3
Dyno-mite, Nexter	pyridaben	greenhouse	two-spotted	contact, moderate persistence	young mites	21
Insecticial Soap	potassium salts of fatty acids	greenhouse & field	two-spotted	knock-down, contact. No persistence	all stages except egg	NA
Dormant oil	mineral oil	field	European red, two-spotted, spruce	contact	all stages	NA
Vendex	fenbutatin oxide	greenhouse & field	two-spotted	contact, moderate persistence	all stages except egg	12
Floramite	bifenazate	greenhouse	two-spotted, Lewis mite	contact, moderate persistence	all stages except egg	25
Forbid	spiromesifen	greenhouse	Two-spotted, broad mite	contact, translaminar, moderate persistence	all stages & eggs, young most susceptible	23
Shuttle, Kanemite	acequinocyl	greenhouse & field	Two-spotted, European red, spruce spider, does NOT control rust mites	contact, knock-down, long persistence	all stages	20B
Apollo	clofentezine	field	Two-spotted, European red, McDaniel	contact, moderate persistence	eggs and young	10

* *check label for specific crop registrations and for phytotoxicity warnings** varies with crop and environmental conditions.* *See Table 7.1, page 17 in the 2008 Floriculture Production Guide*

****Expiry date for registration of endosulfan (Thiodan) is Dec 31, 2016****